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Study on the Prevention and Control of Mass Incidents Based on GIS Technology

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Abstract

According to the characteristics of mass incidents in information society, the network geospatial analysis method is firstly proposed in this paper. As the breakthrough point of early warning research, it is a feasible, intuitive and visual early warning method of mass incidents. From the perspective of geospatial analysis, the geographical distribution of the region of event participants has been taken as the breakthrough point in order to analyze the geographical distribution of sensitive population in spatial map. It is required to use the adaptive learning of artificial intelligence to dig the data and extract the rules of online information as well as provide the analysis for network public opinions. Based on the visual geospatial analysis, the early warning of mass incidents can be made in the intuitive visual map, which can dynamically show the online hot contradictions, the distribution and the trends of irritable crowd in the map.

Key Words: netwok geospatial analysis; online intelligence; network public opinion; mass incidents

1. The mass incidents will be of long standing

In the next period of time, the mass incidents in China will be remained at a high level and the number will be continuously increased. Since 2000, there is an increasing trend for the mass incidents in China, and from 2006 to the present, the number of mass incidents has been also increased above one time. In the next ten years, the mass incidents will be the biggest threat to China's social stability, which are also the greatest challenge for the governing ability of local government.

Preventing and properly handling the mass incidents will inevitably become one of the main battlefields for the future work of public security departments. How to do the early warning of mass incidents, how to do the early detection, the early reporting, the early control and the early settlement as

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well as resolve the contradictions in the bud, all of them have become the urgent needs of public security departments.

2. The characteristics of mass incidents in the information society

According to the statistics, by the end of June, 2009, the number of Internet users in China has reached 338 million. Compared with 2008, it has increased 13.4% and the Internet penetration rate has reached 25.5%. With the improvement of ways and the increase of people and opportunities of surfing the Internet, the network will more profoundly affect our lives and thoughts. Currently, there are 3000 new sites per day in China, 90% of which are the commercial websites outside of the system. The Internet has become the most potential and vibrant new media and the network has been embedded in the real life, which has become the distribution center of thoughts and the amplifier of public opinions.

The online appeal is one of the main methods that broaden the expression channels of social situation and public opinions. Before the occurrence of some mass incidents, there are some signs of outbreak in the Internet, which are mainly: in the network, forum and group space, some appeals have been rapidly become the hot topics and a lot of people will let off the worry, the grievance and the dissatisfaction in the Internet. The dissatisfaction of a single individual is still a personal act. However, a lot of people let off the steam together (in cyberspace), which can arouse the “sympathy” and “resonance” effect. Once these people are in the same region or in the neighboring regions, the number of people will be rapidly increased in order to express the frustration for the same appeal. If this phenomenon is not timely counseled and continuously simmered, or these people are used and incited by some ulterior motives (or foreign hostile forces), then it will be possible to upgrade to the social mass incidents in the real life.

In the past, the mass incidents had certain localization characteristic. The dissemination radius was limited and the social awareness was not high. With the rapid development of Internet, the network has been gradually become the new place that occurs the mass incidents. With the rapid increase of Internet users, the formation ways and the transformation modes of mass incidents have been also changed. After analyzing some mass incidents which have significant impact in recent years, we can find that these incidents have shown a new feature that the inside and outside network have mutually promoted and affected each other.

3. The analysis and the use of online intelligence information

According to the analysis of online intelligence information, we can find that there are some signs and clues for a lot of mass incidents. Then we can make the early warning for the development in advance, timely intervene and guide as well as do a good job deployment. As for the collection and the use of online information, there are some special departments and dedicated staff in the Ministry of Public Security, who have done a lot of analytical work. The Ministry of Public Security has great advantages for obtaining the online intelligence information and they can provide the valuable data source.

3.1. Internet public opinion

The Internet public opinion refers to the social and political attitude held by Internet users for the politicians and the political orientation focusing on the occurrence, the development and the change of intermediary social events in the Internet. In the environment of Internet age, the mass incidents are closely linked to the Internet public opinion. The Internet public opinion will lead to the mass incidents and accelerate its malignant development, which will make the processing more complicated.

Based on the data mining technology and combined with the social network analysis as well as the natural language processing technology, it is required to study the network hot topics, analyze the orientation of public opinions, establish the monitoring system of Internet public opinion and improve the accuracy and the comprehensiveness of Internet public opinion analysis. The network should be regarded as the important channel which "understands the public opinions and gathers the wisdom" and the booster that can improve the government work and promote the scientific development.

3.2. The geographical distribution of cyberspace

As for the obtaining, the analysis and the use of online intelligence information, they have become the hot research topics and have been studied in every country. However, we have just mined and refined the intelligence information itself and the intuitive, dynamic and visual distribution of online intelligence information based on geospatial analysis hasn't been involved. And the mass incidents generally have the following characteristics: the geographical distribution of participants is concentrated, the number of people is rapidly increased, the hot topics are concentrated and the speech of participants is fierce, etc. Through analyzing these characteristics of information, we can make the early warning for some mass incidents in advance as well as timely channel them so as to resolve these incidents in their infancies. As for the geographical space, it is necessary to focus on the speech of overseas speakers and timely find whether there is the infiltration of hostile forces.

The GIS is helpful to analyze and query large amounts of data information as well as display the results in maps. It can realize the pinpointing demonstration, the comprehensive inquiry and the judgment analysis on the electronic map, which can form the trans-regional and cross-police sort comprehensive application. At the same time, it is required to achieve the visualization of decision-making direction, the integration of strike, prevention and control as well as the intensification of information application, which can provide the powerful support for the scientific improvement of combat effectiveness and decision-making analysis.

4. The role of network geospatial analysis in the prevention and control of mass incidents

4.1. The geographic information system and its application in the police

Everything in the physical world is firmly stamped the brand of time and space and more than 80% of information in people's production and life are related to the geospatial position. The GIS (Geographic Information System) refers to the system in which the spatial data has been collected, managed, operated, analyzed, simulated and displayed according to the geographical coordinates or the spatial location under the support of computer technology. Through the comprehensive analysis, the corresponding processing results are shown in the forms of map, graphic or data so as to serve the command decision making. Because of the following characteristics such as the visual image, the flexible operation and the strong functions, etc, the GIS has been widely used in many fields.

In the mass incidents, the abrupt incidents and the anti-terrorist activities, the GIS has provided the strong visual information support for the cooperation of multiple police sorts and the emergency treatment. It can effectively improve the ability and the level of the operational command, the management analysis and the rapid response of public security as well as achieve the concentrated visual display and the comprehensive analysis of police data.

4.2. The characteristics of the application of geographic information system in the prevention and the control of mass incidents

It is very practical to apply the geographic information system to the prevention and control study of mass incidents.

The purpose is to conduct the early warning research of mass incidents.

The data resource is the online intelligence information (including the intelligence of public security, the popular chat rooms, the hot topic forums, the QQ group space and the mobile phone space, etc).

The method refers that the geographic information is extracted based on the analysis of geographic information (including the ascription region of IP addresses, the ascription region of mobile phones, the GPS positioning area of mobile phones, etc).

The means refers to the data mining and the rule modeling of online intelligence.

The result refers to the geographical distribution of sensitive people in the spatial maps and the geographical distribution situation is shown in the maps.

4.3. The main contents

The geographic information system will bring the traditional database to the visual space and make up for the limitations for analyzing the data in the current conventional information application systems, which can make the manager have a comprehensive and intuitive understanding for the all aspects as well as give overall arrangements. At the same time, it can also greatly improve the aided decision-making level of modernized operation and management. The main contents have integrated some advanced theories such as the geographic information system, the data mining, the data modeling and rule analysis, the semantic tendentiousness analysis and the machine learning and so on, which include:

(1) The collection of geospatial database

It is necessary to integrate the information such as the ascription region of IP addresses, the ascription region of phone numbers and the GPS positioning area of mobile phones to carry on the data collection and establish the geospatial database.

(2) The design of the GIS analysis platform

It is required to use the GIS technology to integrate the map which has the unique visualization effect, the geographic analysis capabilities with the general database operation (e.g. the query and statistical analysis). The spatial thinking functions of the GIS can make us reveal the spatial relationships, the spatial distribution patterns and the spatial development trends and these tasks can’t be completed by other information systems.

(3) The analysis and the rule mining of online intelligence information

As for the nonstandard and language sparse characteristics of online intelligence information, we should combine with the context to design the extraction algorithm of topic feature words based on word co-occurrence network as well as detect and track the hot issues. It is necessary to establish the multi-level semi-supervised learning model for the semantic tendency analysis to analyze the viewpoints of hot issues.

(4) The model construction and the machine learning

It includes the machine learning and knowledge acquisition, the automated reasoning and the search methods, the auto-adaptive or auto-organized pattern recognition, the spatial modeling and the analysis.

(5) The address matching technology

The regional public security has established a large number of application systems and formed some databases. These databases basically have the location information. They must be combined with the geographic information so as to achieve the visualization analysis based on electronic maps. The application of address matching technology will greatly improve the application efficiency of data resources.

4.4. The technology programs and the implementation model

It is required to establish the GIS connection application of intelligence analysis research system and achieve the visualization display of the statistical analysis results of the business information and the resource data information on electronic maps relying on the distribution maps, the class maps, the range maps and the density maps.

The achieved technology programs are as follows:

(1) The Internet public opinion is analyzed based on the machine learning and the natural language processing. It is necessary to extract the online hot topics and analyze their views. As for the mass incidents that have occurred, we should integrate the analysis results and establish the baseline model through the information abstraction, the information management and the analysis.

(2) Through the analysis of online intelligence information (the intelligence of public security, the popular chat rooms, the hot topic forums, the QQ group space and the mobile phone space, etc), the geographic information has been extracted (including the ascription region of IP addresses, the ascription region of mobile phones, the GPS positioning area of mobile phones, etc) and the geographical distribution has been shown in maps.

(3) If the participants in local areas are specially concentrated and this phenomenon is continuous and rapidly developed as well as the speech is intense, which has surpassed the model threshold, then the alarm will remind (the regions in maps are shown in red). As for these foreign participants who have appeared in the regional spatial maps, we should pay more attention to them.

5. Conclusion

As the network has the relatively free and open features, the anonymous communication has become normal. The remodeling of roles as well as the multiple playing of roles has completely discharged even destroyed the “real identity” of people in real lives. The characteristics of high power “amplifier” and rapid “communication device” of network as well as the invigoration effect of “group polarization effect” will lead to or exacerbate the occurrence of mass incidents. The phenomenon that the prevention of mass incidents is carried out based on the visual geospatial analysis has the characteristics of originality and practicality. The use of network geospatial analysis can enhance the ability of public security to deal with the mass incidents as well as be helpful to the timely early warning, the rapid positioning, the assistant scheduling and the assistant decision making. It is a new method and means, which has the important theoretical and practical value.

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